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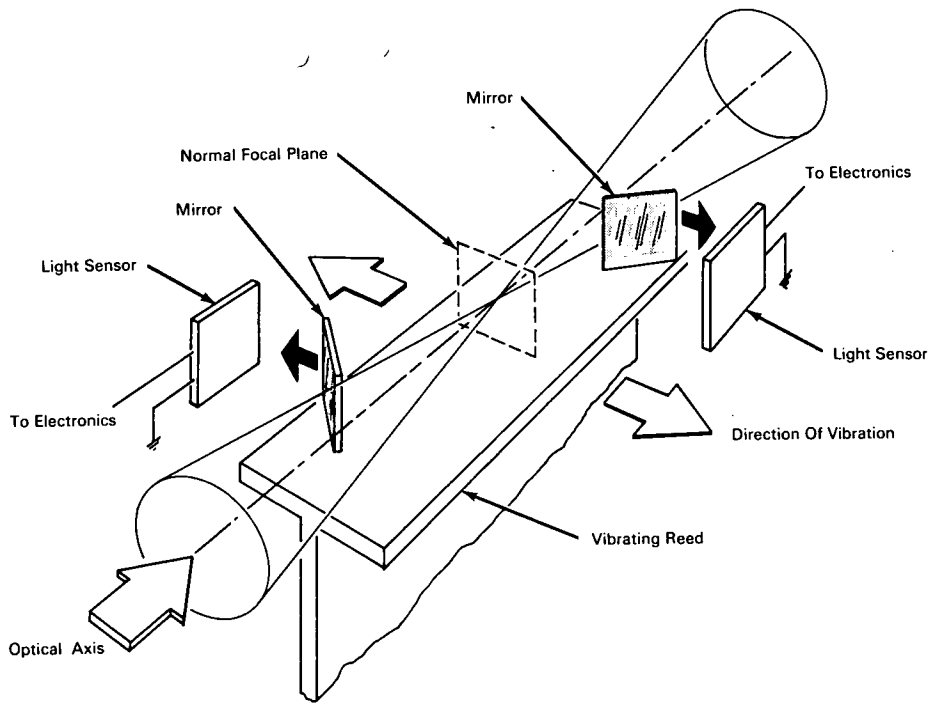
NASA TECH BRIEF

Light Ray Modulation Controls Optical System Alignment



The problem: Detecting the magnitude and direction of a shift in the focus of a concentric, reflective optical system, and automatically returning the system to proper focus.

The solution: A system that modulates the incident light rays on either side of and equidistant from the normal focal point. The modulated signals are used to drive a servo system that aligns the system optics.

How it's done: The light rays are modulated by two mirrors mounted on a reed that vibrates in a plane perpendicular to the optical axis. The mirrors are positioned at a 45° angle to the optical axis and 90° to each other. As the reed vibrates, the mirrors swing through the envelope of the light rays, modulating the rays. The modulated rays are reflected to light sensors located in the respective light paths of the mirrors. Because the envelope in a concentric, reflective optical system is a pair of hollow cones with a common vertex at the focal point, the output of the light sensors takes the form of pulses. Pulse widths of the signals from the respective sensors are measured and compared. Equal pulse widths from the two sensors indicate that the focal point is correct. In the case of unequal pulse widths, their ratio indicates the magnitude (in increments of distance) and direction (short or beyond the

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nominal) of the focus shift. An error signal is produced and routed to a servo system that returns the focus to its proper point by movement of an appropriate optical component.

Notes:

1. This innovation would be useful in maintaining focus in optical systems subject to severe thermal gradients, vibration, or shock.
2. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland, 20771
   Reference: B65-10211

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

Source: Kollsman Instrument Corporation
under contract to
Goddard Space Flight Center
(GSFC-171)